



Study of avian diversity in urban areas of Gujranwala, Pakistan

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SUMMARY

Avifauna diversity of densely populated and important agricultural district Gujranwala in Punjab province was assessed for a period of one year. The area was initially part of tropical thorn forest and was changed into urban and agriculture landscapes. Present study was planned to assess the avian diversity of urban and peri-urban areas of Gujranwala district. The data were calculated through computer-based software PAST to record the diversity indices. A total of 22 avian species were noted from urban areas of Gujranwala. It was noted that the diversity was rich in peri-urban as compared to urban habitats. It can be concluded from the present study that food, shelter and nesting habitats are the main factors that influence avian diversity and urban habitats are favorable for generalist bird species.

Keywords: Birds, Gujranwala, Diversity, Agriculture

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INTRODUCTION

Urban study have been unnoticed with other study during research (Miller and Hobbs, 2002; Lugo, 2010; Kowarik, 2011; Perring *et al.*, 2013) till mid of the 20th century, while urban study started from 1960s to 1970s; different researches emerged in urban ecosystem (Ishitani *et al.*, 2003; Clergeau *et al.*, 2006; Musacchio, 2009; Bettencourt and Kaur, 2011; Wu, 2012; Wu, 2013). At that time urban ecosystem became challenge for scientist (Miller and Hobbs, 2002). This was all due to rapid increase in population at that time, created a negative impact on the most of avian species (Bierwagen, 2007; Hakeem *et al.*, 2017; Rauf *et al.*, 2017; Ashraf *et al.*, 2018).

The urban ecosystems are dissimilar from the original habitats and with the development of new residential areas and also larger area have been split (McKinney, 2002), the natural plantation (McNeill, 2000) and a lot local species have been replaced with exotic ornamental plants or agriculture plants (Holway and Suarez, 2006; Umair *et al.*, 2017; Umair, 2020). So, the landscapes have been changes in urban agriculture and industries. While, rural areas with vegetation and ponds enhances diversity of few species by providing foraging and nesting sites (Blair, 1996). In Intensive urban areas the population of birds species decline (Blair, 2001; Umair, 2018; Ali *et al.*, 2020).

Urbanization creates different impacts on the different birds, some birds are increased in numbers while other are decreased. Urbanization favors omnivores,

granivores, and insectivores and resident's bird's species are dominant over migrant's birds (Poague *et al.*, 2000; Garaffa *et al.*, 2009; Haider *et al.*, 2017; Hakeem *et al.*, 2017; Rauf *et al.*, 2017; Ashraf *et al.*, 2018; Bashir *et al.*, 2018; Bibi *et al.*, 2019), while specialist bird are more negatively affected by urbanization (Emlen, 1974; Faulkner, 2004).

Urbanization provides better feed for birds e.g. omnivores, granivores, insectivores and nectivores (hummingbirds, jays, chickadees, nuthatches, woodpeckers, juncos, finches, sparrow and grosbeaks) get food from the vegetation, residents dominant than migrants (Poague *et al.*, 2000), while scavenging and omnivores (e.g. gulls, jays, ravens, blackbirds, crows and European starlings) get food from the spilled waste (Boadi and Kuitunen, 2002; Shwartz *et al.*, 2008). Food resources are affected by changes in plant diversity, exotic vegetation has fewer insects than native vegetation and urban lawns have high feeding grounds (Parsons *et al.*, 2006), these changes favor ground foragers and granivores. Previous research indicated that specialist's species of birds were more negatively affected by urbanization. Indeed, generalist species of birds have better colonizing abilities and to better manage with urban and agricultural disturbance (Fernández-Juricic, 2004; Devictor *et al.*, 2008a; Devictor *et al.*, 2008b).

The avian species are good environment indicators (Khan *et al.*, 2021) and help to recognize main concern areas for landscape conservation (Myers, 1990; Bibby, 1999; Myers *et al.*, 2000). Main threats to avian species are agriculture intensification, urbanization, illegal hunting, pollution, eutrophication traditional uses. Urban ecosystem research is very significant to know the threats and status of the birds in urban landscape; so this study designed to identify the status and diversity of the urban birds of district Gujranwala, Punjab, Pakistan.

MATERIALS AND METHODS

The data were collected from May 2020 to April 2021. The data was collected at early morning and before sun set and on monthly basis from Gujranwala (Figure 1).

STUDY AREA

Gujranwala district has of 3,622 Km² area, with human populations of “4.48 million” (Sheikh, 2012). Three sub-areas in Gujranwala were selected and each area consists of the 900 ha (hectare). These areas were scanned through Google Earth and Arc GIS (basic) for the selection of the sites.

CLIMATE

The urban area is situated along the tropical thorn forest with temperature variations of 0°C in winter to 45°C in summer (Altaf, 2016).

METHODOLOGY

The urban bird diversity was documented through “linear count survey” and while, the direct (i.e. direct observations and avian voices) and indirect (i.e. nests, dead body, body parts and group questionnaire survey) methods were utilized. For identification of avian species, books were used “Birds of Pakistan” (Roberts, 1991, 1992; Grimmett, 1998; Mirza and Wasiq, 2007).

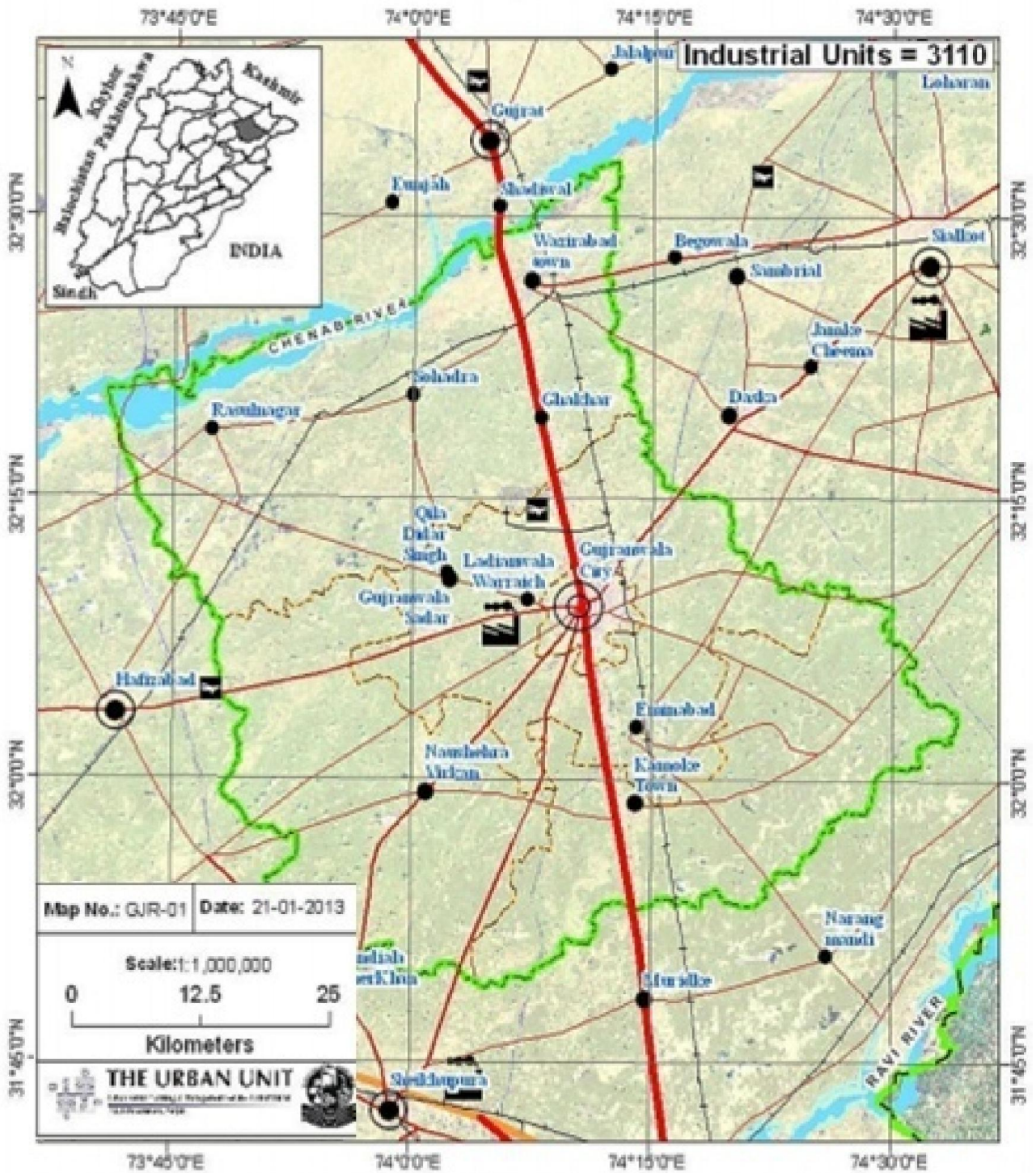


Figure 1: Map of study area (Sheikh, 2012).

STATISTICAL ANALYSIS

The collected urban bird data was calculated through computer-based software known as “PAST version 2.17C”. “Shannon-Wiener diversity index”, “Simpson Index”, “Margalef” and “Evenness” were recorded (Hammert, 2001).

FLORAL DIVERSITY

About 35% in rural, 20% in semi intensive urban and one percent in intensive urban land are used for plantation and/or agriculture purposes. The main crops are rice, wheat, corn, sugarcane and fodder for cattle. Natural flora consists herbs, shrubs and trees i.e. semal, dharek, neem, jamun, bohr, pipal and beri.

RESULTS AND DISCUSSION

In this survey, a total of 22 species of bird were recorded from the study area (Table 1). “Simpson index” (i.e. 0.8501), “Shannon-Wiener diversity index” (i.e. 2.145), “Evenness” (i.e. 0.3882) and “dominance” (i.e. 0.1499) were recorded (Table 2). Iqbal *et al.* (2007) recorded 74 avian species from the Lahore Cantonment; representing to 55 genera, having 38 families and 13 orders.

During present study noted that common swallow (0.193), Indian kite (0.177), house crow (0.177), common myna (0.161), little swift (0.149), house sparrow (0.035), common babbler (0.019), bank myna (0.018) and common rock chat (0.013) were to abundant birds of the study area (Figure 2).

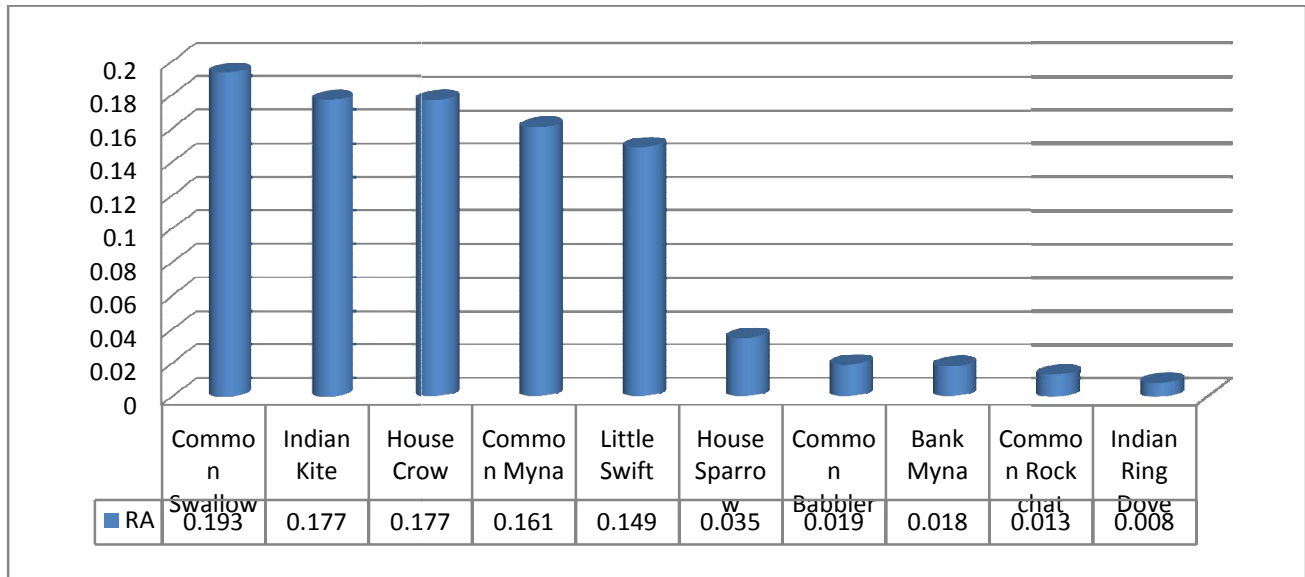


Figure 2: The Most abundant avian species in urban areas of Gujranwala.

Feeding habitats of birds species (i.e. 8 omnivore, 6 insectivore, 2 carnivore and 2 Piscivore) as shown in Figure 3 and distribution (i.e. 16 resident bird, 2 summer breeder, 3 winter visitor and 1 year round visitors) is shown in Figure 4. Iqbal *et al.* (2007) recorded out of 74 species; out of the total 44 = resident, 17 = winter visitors and 13 species are summer visitors. Ornithologists (Altaf *et al.*, 2012; Ali *et al.*, 2018; Ashraf *et al.*, 2018; Jadoon *et al.*, 2019; Mughal *et al.*, 2020) also reported avian species from Chakar, Hattian Bala district, Azad Jammu and Kashmir, district

Haripur, Khyber Pakhtunkhwa, district Sargodha, district Gujranwala in province of Punjab, and district Badin in province of Sindh, Pakistan.

These birds like bank myna, blue rock pigeon, common myna, common rock chat, house crow, Indian kite, Indian ring dove, little brown dove, purple sunbird, red-wattled lapwing, and house sparrow are observed all kind of areas i.e. rural, sub urban area, intensive urban area, low intensity roads and even high intensity roads. These species are also commonly seen on the wires, towers, trees and flying near the roads. Black kites usually form the nests at the height of longest towers while crows make nest on small towers and trees.

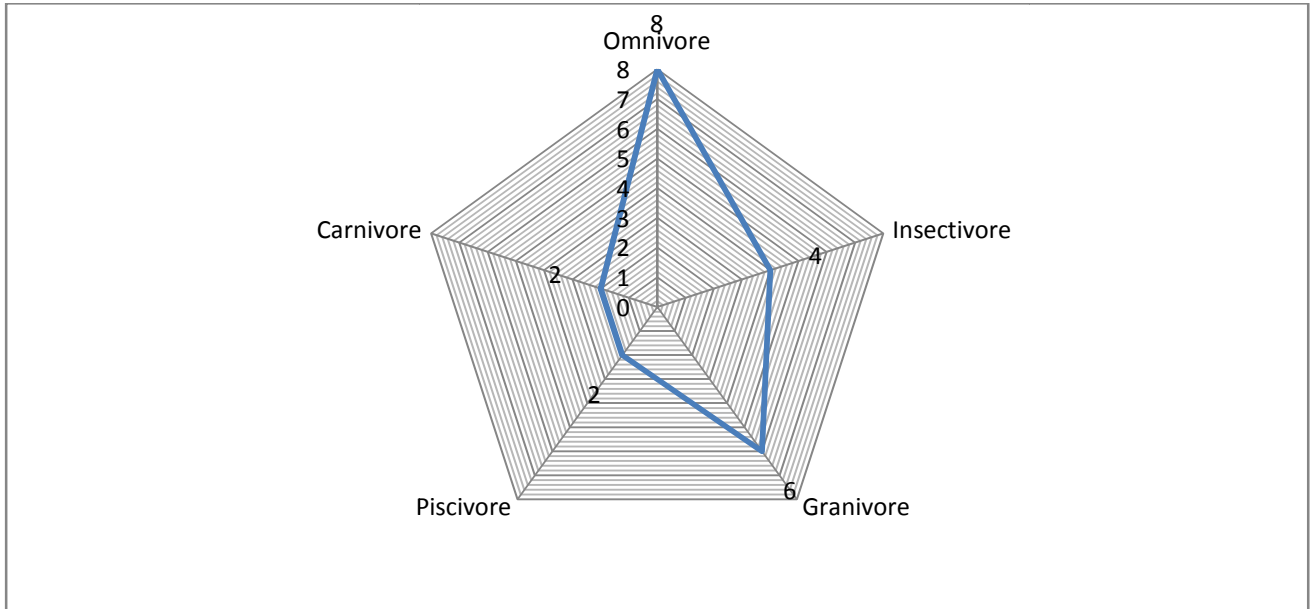


Figure 3: Feeding habits of avian species in urban landscapes of Gujranwala.

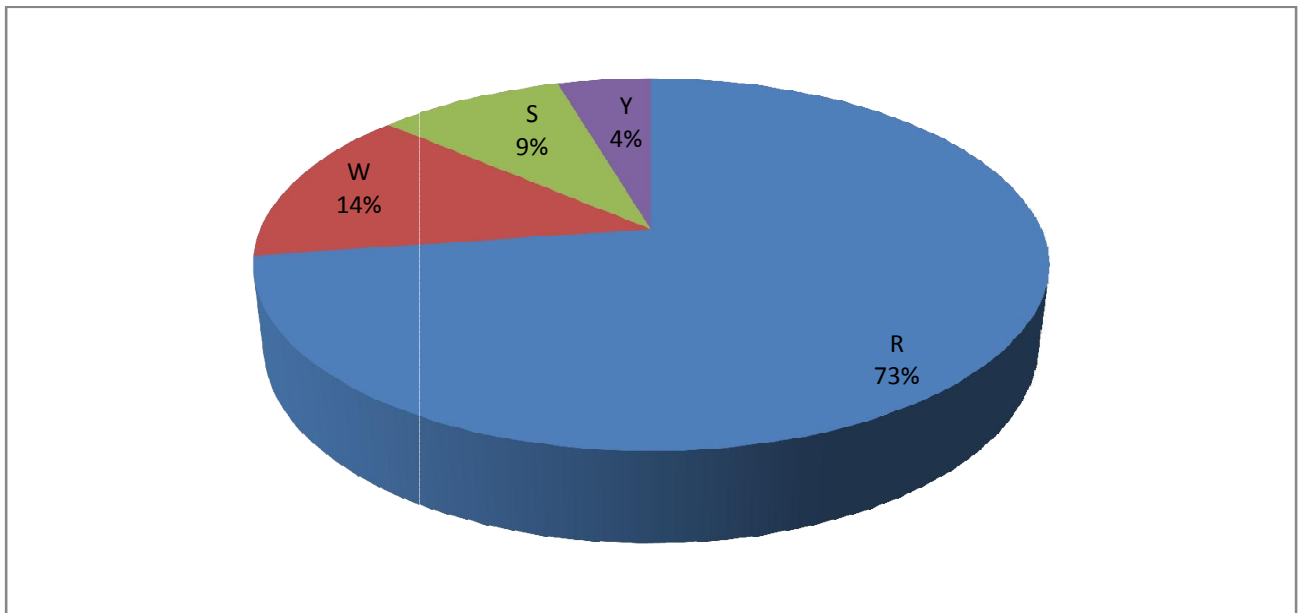


Figure 4: Distribution of birds in Gujranwala.

Oriental turtle dove, common hoopoe, and red-vented bulbul are common in urban (both intensive and semi-intensive) and peri-urban habitats. Little swift and common swallow are usually common and nests are seen under the bridge near lakes, canals and ponds. Oriental turtle dove is observed in sub urban and rural areas, and usually seen at trees. Common hoopoe is seen at ground. Red-vented bulbul is commonly seen on the trees and also forms their nest on trees in rural and even in urban areas.

Garbage in urban core has food for avian species, which was produced by carnivorous and omnivorous mammalian species especially human waste material (Boadi and Kuitunen, 2002; Shwartz *et al.*, 2008). These results suggest that open habitat with the occurrence of foodstuff for bird is a main reason in the avian distribution. Intensive and semi urban landscapes offer foodstuff and shelters i.e. roofs, gardens, waste sites, small wet places and houses spaces. The fear of humans may be a main reason for the distribution of avian species, which use plant food in the rural habitat, to avoid human involvement.

CONCLUSION

It is concluded that food, shelter and habitats are the main factors to change the diversity in native areas; urbanization create positive impact on omnivorous and insectivorous birds. Herbivore, frugivore, carnivore and granivore have a negative correlation with urbanization. It is noted that urbanization enhances the diversity and richness of birds in semi intensive urbanization while decrease the population size and species number in intensive urbanization.

Table 1: Summary of the birds of Gujranwala.

Common and Scientific name	Family and Order	Food/diet	IUCN status and Occurrence	RA
Bank Myna	Sturnidae	Omnivore	LC	0.018
<i>Acridothera ginginianus</i>	Passeriformes		R	
Common Myna	Sturnidae	Omnivore	LC	0.161
<i>Acridothera tristis</i>	Passeriformes		R	
Little Swift	Apodidae	Insectivore	LC	0.149
<i>Apus affinis</i>	Apodiformes		R	
Spotted Little Owllet	Strigidae	Carnivore	LC	0.005
<i>Athene brama</i>	Strigiformes		R	
Cattle Egret	Ardeidae	Piscivore	LC	0.003
<i>Bubulcus ibis</i>	Pelecaniformes		R	
Common Rock chat	Turdidae	Insectivore	LC	0.013
<i>Cercomela fusca</i>	Passeriformes		W	
Blue Rock Pigeon	Columbidae	Granivore	LC	0.005
<i>Columba livia</i>	Columbiformes		R	
House Crow	Corvidae	Omnivore	LC	0.177
<i>Corvus splendens</i>	Passeriformes		R	
Little Egret	Ardeidae	Piscivore	LC	0.006
<i>Egretta garzetta</i>	Pelecaniformes		Y	
Common Swallow	Hirundinidae	Granivore	LC	0.193
<i>Hirundo rustica</i>	Passeriformes		W	
Red-wattled Lapwing	Charadrius	Insectivore	LC	0.003
<i>Hoplopterus indicus</i>	Charadriiformes		R	
Indian Kite	Accipitridae	Omnivore	LC	0.177
<i>Milvus migrans migrans</i>	Accipitriiformes		R	

Purple Sunbird	Nectariniidae	Omnivore	LC	0.003
<i>Nectarinia asiatica</i>	Passeriformes		S	
House Sparrow	Passeridae	Omnivore	LC	0.035
<i>Passer domesticus</i>	Passeriformes		R	
Rose-Ringed Parakeet	Psittacidae	Omnivore	LC	0.003
<i>Psitta krameri</i>	Psittaciformes		R	
Red-vented Bulbul	Pycnonotidae	Omnivore	LC	0.006
<i>Pycnonotus cafer</i>	Passeriformes		R	
Indian Ring Dove	Columbidae	Granivore	LC	0.008
<i>Streptopelia decaocto</i>	Columbiformes		R	
Oriental Trutle Dove	Columbidae	Granivore	LC	0.003
<i>Streptopelia orientalis</i>	Columbiformes		W	
Little Brown Dove	Columbidae	Granivore	LC	0.006
<i>Streptopelia senegalensis</i>	Columbiformes		R	
Red Turtle Dove	Columbidae	Granivore	LC	0.003
<i>Streptopelia tranquebarica</i>	Columbiformes		S	
Common Babbler	Timaliidae	Insectivore	LC	0.019
<i>Turdoides caudatus</i>	Passeriformes		R	
Common Hoopoe	Upupidae	Carnivore	LC	0.003
<i>Upupa epops</i>	Coraciiformes		R	

Note: Dist. (Distribution); RA (Relative Abundance)

Table 2: Statistical analysis of the birds of Gujranwala.

Indices	Value
Species	22
Dominance index	0.1499
Simpson diversity index	0.8501
Shannon diversity index	2.145
Evenness index	0.3882

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